Computer Engineering Department
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LAB09: Image Restoration in the Spatial Domain

Objectives

Upon completion of this lab, you will be able to:

1. Explain the different types of spatial filtering for image restoration.
2. Write a user-defined function in MATLAB to remove noise using linear filtering, including Harmonic mean filtering and Alpha-trimmed mean filtering.
3. Write the user-defined function in MATLAB to remove noise using non-linear filtering (Order-statistics filtering), including Min filtering, Max filtering, and Mid-point filtering.
4. Write the user-defined function in MATLAB to remove noise using Adaptive median filtering.

Exercises

Note that you should create your own function in MATLAB as MATLAB User-defined function. It means that you cannot call MATLAB built-in function, which generates output in the same manner as your own function. You can use the images provided in the folder **\Google Drive\EGCI486-Image Processing\Second(2015-2016)\LABs\LAB09** for your exercises.

1) Image restoration in spatial domain using linear filtering

1.1 Consider the original image that has been corrupted with three different noises. First image is corrupted by Salt noise. Second image is corrupted by Gaussian noise. Third image is corrupted by Pepper noise. Write the user-defined function in MATLAB to filter three noisy images with a 3×3 Harmonic mean filter using reflect padding. Take the following program name: Myharmomf.m. When this program is used with three noisy images, "circuit-board-salt.tif", "circuit-board-gauss.tif" and "circuit-board-pepper.tif", the result as shown in Figure 1.

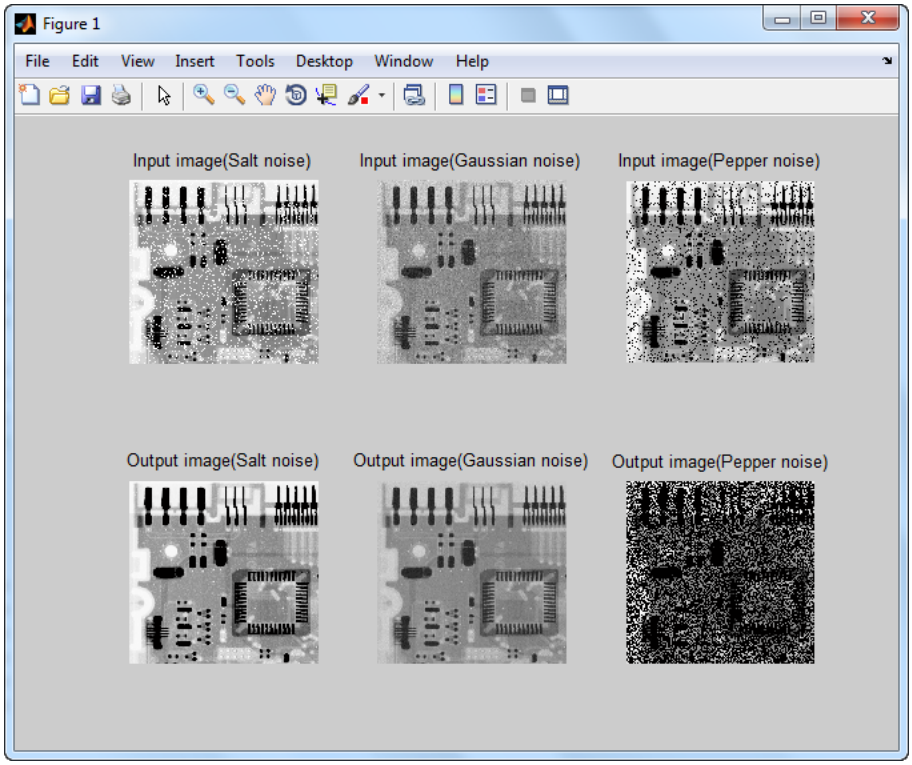

Figure 1: The result of applying the 3×3 Harmonic mean filter (with m of 3 and n of 3) on three noisy images.

1.2 Consider the original image that has been corrupted with two different noises. First image is corrupted by Salt and Pepper noise. Second image is corrupted by Gaussian noise. Write the user-defined function in MATLAB to filter two noisy images with a 5×5 Alpha-trimmed mean filter using zero padding. Take the following program name: Myalphatrim.m. When this program is used with two noisy images, "circuit-board-saltpep.tif" and "circuit-board-gauss.tif", the result as shown in Figure 2.

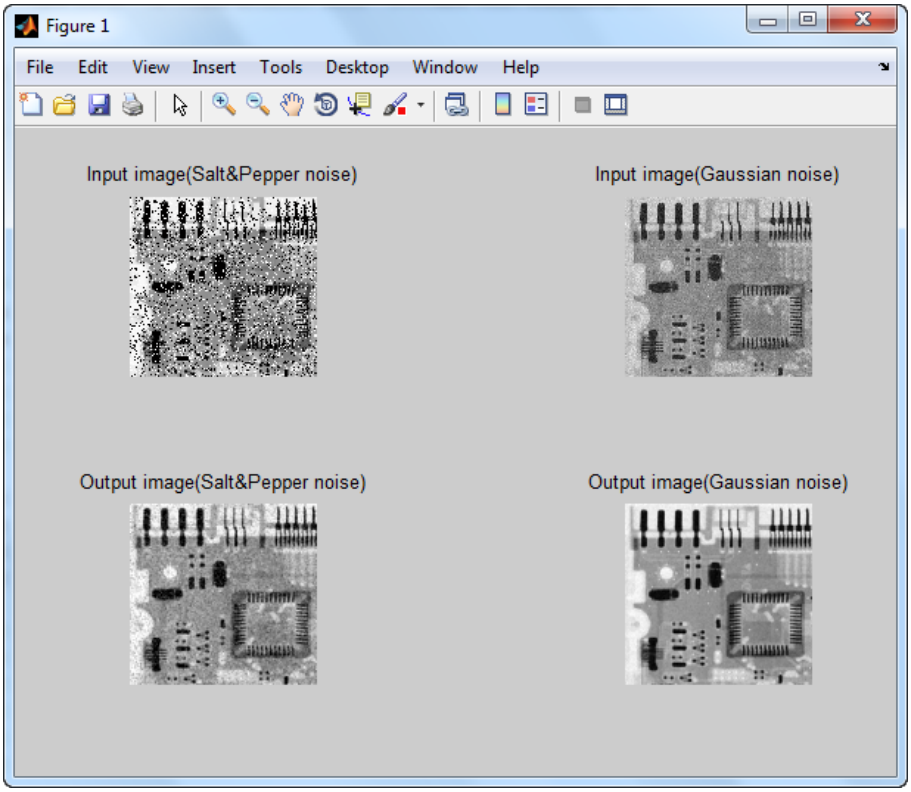

Figure 2: The result of applying the 5×5 Alpha-trimmed mean filter (with m of 5, n of 5, and d of 2) on two noisy images.

2) Image restoration in spatial domain using non-linear filtering (Order-statistics filtering)

2.1 Consider the original image that has been corrupted by Pepper noise. Write the user-defined function in MATLAB to filter the noisy image with a 3×3 Max filter using zero padding. Take the following program name: Mymax.m. Using this program on the image "circuit-board-pepper.tif" should give you result as shown in Figure 3.

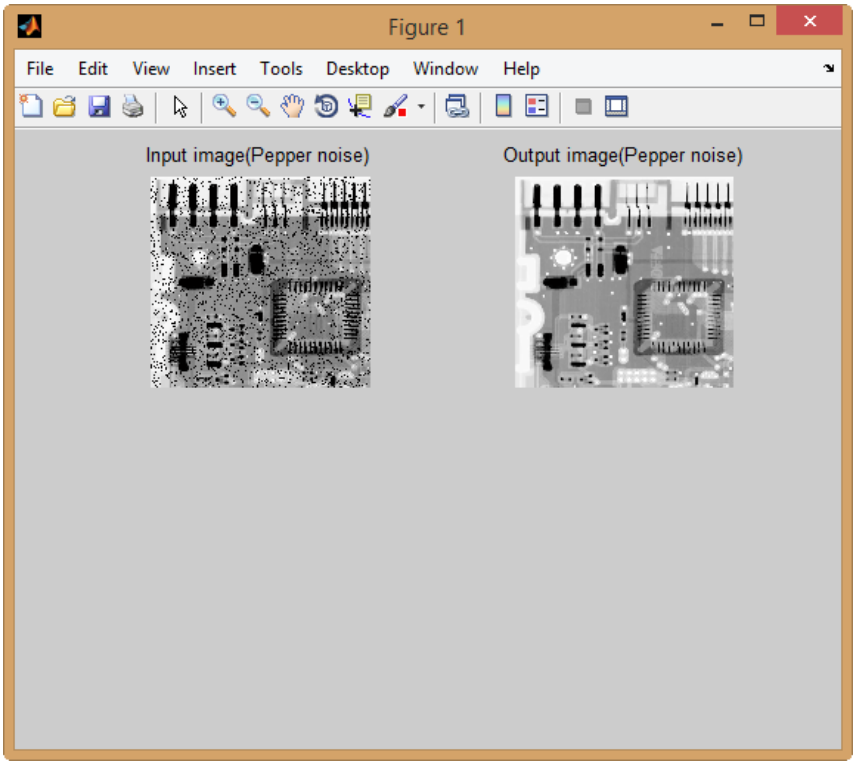

Figure 3: The result of applying the 3×3 Max filter (with m of 3 and n of 3) on the noisy image.

2.2 Consider the original image that has been corrupted by Salt noise. Write the user-defined function in MATLAB to filter the noisy image with a 3×3 Min filter using zero padding. Take the following program name: Mymin.m. Using this program on the image "circuit-board-salt.tif" should give you result as shown in Figure 4.

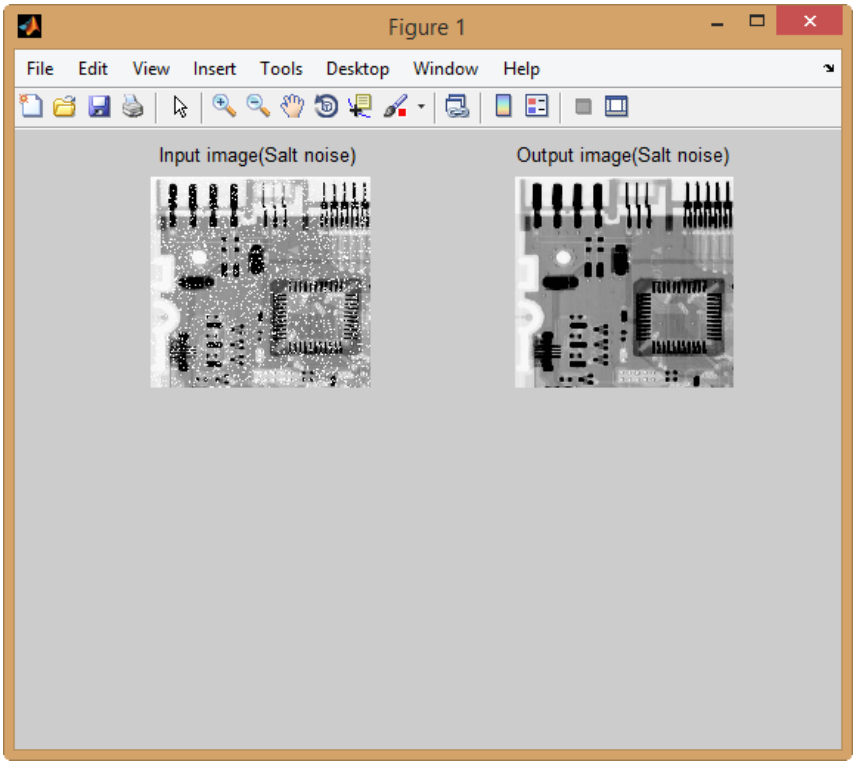

Figure 4: The result of applying the 3×3 Min filter (with m of 3 and n of 3) on the noisy image.

2.3 Consider the original image that has been corrupted by Gaussian noise. Write the user-defined function in MATLAB to filter the noisy image with a 3×3 Mid-point filter using zero padding. Take the following program name: Mymidpoint.m. Using this program on the image "circuit-board-gauss.tif" should give you result as shown in Figure 5.

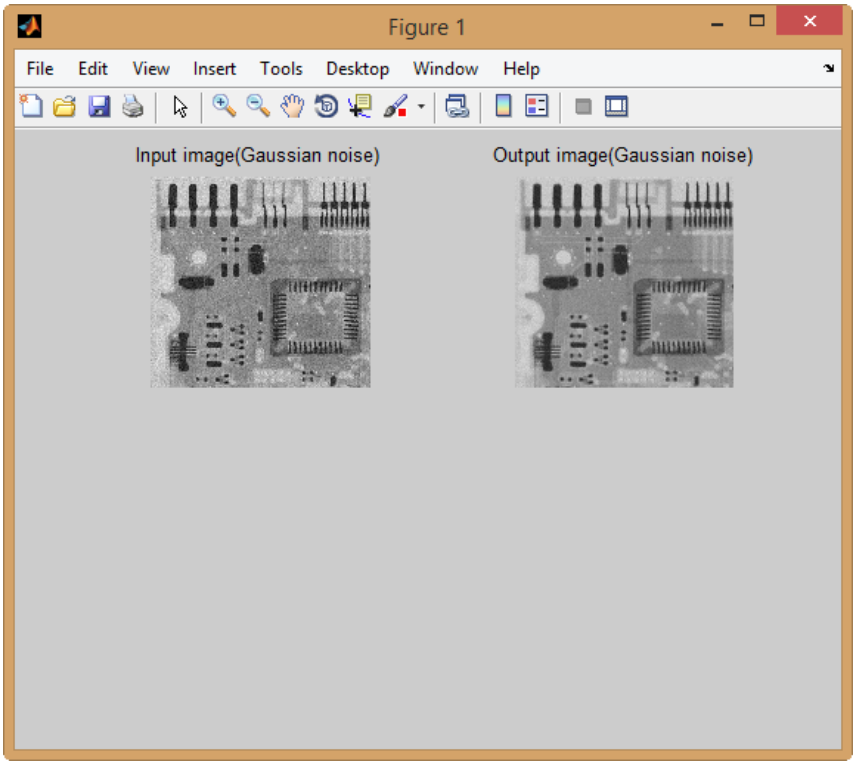

Figure 5: The result of applying the 3×3 Mid-point filter (with m of 3 and n of 3) on the noisy image.

3) Image restoration in spatial domain using Adaptive median filtering

3.1 Consider the original image that has been corrupted by Salt and Pepper noise with p_a of 0.25 and p_b of 0.25. Write the user-defined function in MATLAB to filter the noisy image with a 3×3 Adaptive median filter using zero padding. Take the following program name: Myadaptmed.m. Using this program on the image "circuit-board-saltpep_025.tif" should give you result as shown in Figure 6.

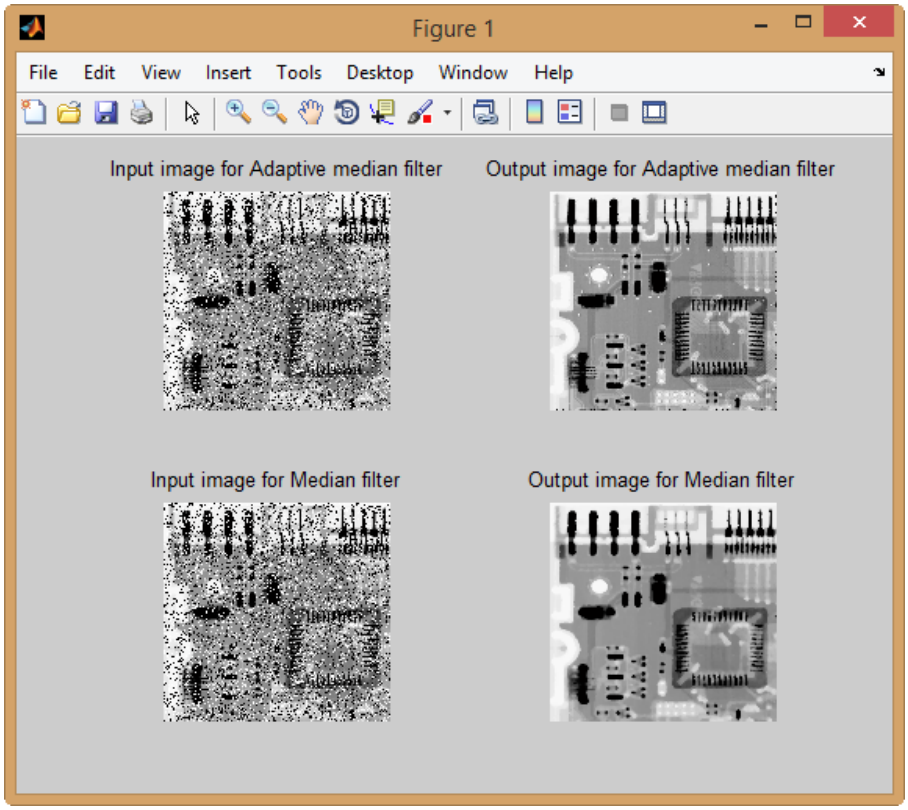

Figure 6: The result of applying the 3×3 Adaptive median filter (with m of 3, n of 3, and Smax of 7) on the noisy image, and the 7×7 median filter (with m of 7 and n of 7) on the noisy image.